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TREATMENT OF TWO CASES OF RADIATION SICKNESS

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The authors of this report have observed two patients who developed acute radiation sickness as a result of brief general exposure to external gamma radiation and neutron radiation to which they were subjected by reason of the fact that the rules in regard to the operation of an experimental reactor had been violated.

According to the calculations which had been carried out, one of the patients received a dose of radiation which amounted to about 300 roentgens, while the other received a dose of 450 roentgens. In both cases, the typical syndrome of acute radiation sickness developed with different degrees of the manifestation of clinical symptoms. A brief description of the case histories follows.

Twenty minutes after exposure to the radiation, the patient, M, complained about acute general weakness, a headache, sleepiness, and nausea. Within an hour profuse vomiting set in which stopped only after the stomach had been pumped out repeatedly.

Six to seven hours after the irradiation the patient complained only about general weakness which was not very acute or pronounced and was accompanied by nausea. The patient willingly stayed in bed but refused all food. A general state of illness and depression continued for 3 days. The temperature of the body was normal and the pulse was not accelerated. The arterial pressure amounted to 105/60 mm of mercury. No changes were observed as far as the internal organs are concerned.

Up to the 24th day of the illness, the general well-being of the patient remained satisfactory. The temperature of the body was normal. Tachycardia and instability of the arterial pressure with a tendency towards hypotension were present. As far as neurological symptoms are concerned, there was a lowering of the muscular tonus which slowly increased in magnitude.

Beginning with the 13th day of the illness, falling of the hair from the scalp began. During this period of time the number of leukocytes in the peripheral blood fluctuated between 3,000 and 4,000. In the leukocytic formula there was a pronounced shift to the left. Relative lymphopenia and monocytosis were also observed. Beginning with the 15th day of the disease, thrombocytopenia began to develop and progressed rapidly. When the spinal cord was subjected to investigation on the 23d day of the illness, the quantity of nucleated cells was found to be sharply reduced. The data of an electroencephalographic examination indicated a reinforcement of the inhibition processes in the cerebral cortex.

On the 24th day of the illness the general well-being of the patient took a sharp turn for the worse. A pronounced general debility appeared and insomnia set in. The temperature went up to 38° C. Petechial hemorrhages developed in the skin. In the blood there was a rapid reduction of the number of leukocytes, the leukocyte count dropping at about the 33d day to 780 leukocytes per cu mm. Toward the 34th day of the illness, the knee, Achilles tendon, and abdominal reflexes disappeared completely.

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The period during which the general condition of the patient deteriorated continued for about 20 days.

Toward the 70th day of the disease there was almost complete normalization of the hemopoiesis. The restoration of the functions of the central nervous system, as indicated by the data of physiological tests, took place somewhat more slowly.

Three months after the onset of the illness the patient was released and was capable of resuming work. Medical observations carried out on the patient for 1 1/2 years subsequently to recovery indicated complete restoration of the capacity to work and the absence of any significant disturbances in his health.

The second patient, Kh., had a much more acute form of the sickness. During the first few minutes after exposure to radiation, he developed pronounced general weakness, headache, and vertigo. His appetite disappeared and nausea and vomiting set in. These symptoms continued for 3 days. The patient was listless and adynamic. As far as the condition of the blood was concerned, neutrophilic leukocytosis and relative lymphopenia were present. On the 4th day the well-being of the patient improved and remained satisfactory up to the 19th day of the illness. At this point a sharp worsening of the condition of the patient took place. During the following 13 days the general condition of the patient was highly critical. There were recurrent chills accompanied by shivering. The temperature remained at the level of 39-40° C. A pain in the throat developed and there were multiple hemorrhages on the skin and the gums. The tonsils showed edema and hyperemia. On the right tonsil an extensive necrotic region appeared.

Beginning with the 19th day of the illness a sharp reduction of the number of leukocytes in the peripheral blood set in. This reduction was expressed principally in a disastrous lowering of the number of neutrophils (down to 150 cells per cu mm), and a progressive thrombocytopenia developed. All these changes were most pronounced toward the 27-29th day of the illness. On the 22d day, the total count of nucleated cells in the spinal punctate amounted to no more than 4,000. However, toward the 30th day of the disease, there were distinct signs of regeneration of the spinal cord, while the reduction of the total number of cells in the spinal punctate was still very pronounced.

Toward the 35th day the fever was broken and the temperature dropped to normal, the well-being of the patient improved, there was an improvement of appetite, and the headaches ceased. Up to the 40th day the gums remained loose and had a tendency to bleed. There also was hyperemia and an edematous condition of the tonsils remained. A complete detachment of the necrotic region took place on the 40th-41st day of the illness.

In the 3d month after the start of the illness, clinical recovery of the patient could be assumed to have taken place. Examination of the patient at this time did not show any significant deviation from the normal as far as the condition of the internal organs and of the nervous system was concerned. Toward the end of the 4th month of the illness, the patient was sent to a sanitarium. After leaving the sanitarium he resumed work in his special field. The patient was under observation for 1 1/2 years after recovery. During this time his condition remained satisfactory and his capacity to work was almost completely restored.

In the treatment of the patients a combination of well-known drugs and methods was used, i.e., antibiotics, hemostatics, and stimulants of blood-formation were administered. Both patients were hospitalized after they had left the zone of irradiation. The patients stayed in bed and received a diet consisting of protective food which contained a sufficient number of calories and was rich in proteins and vitamins. In addition to this they received vitamins B<sub>1</sub>, B<sub>6</sub>, and C internally in the customary doses.

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Beginning with the first day, they received penicillin in a quantity of up to 800,000 units per day and were given transfusions of medium doses of whole blood. Beginning with the 12-15th day, the dosage of penicillin was increased and in addition to that streptomycin, a solution of calcium chloride, ascorbic acid, and vicasol [the bisulfite derivative of 2-methyl-1,4 naphthoquinone] were administered.

Beginning with the turn for the worse in the condition of the patients, the greatest threat to their lives was formed by hemorrhages and complications due to infection. For that reason, particular importance was attached to general care of the patients, treatment of the oral cavity with solutions of antibiotics, and proper care of the skin. The food which was administered was rich in calories, easily assimilable, and contained a sufficient quantity of vitamins. It was given to the patients in a finely dispersed, strained, and slightly heated state. The patients were given a profuse quantity of liquids to drink. During this period, blood transfusions were administered in quantities of 200 milliliters by the drip method.

The patient who had received the larger dose of radiation developed acute posttransfusion reactions. To alleviate these reactions, administration of pantopon and atropine prior to the blood transfusions was resorted to. The patients received cardiovascular stimulants and were subjected to oxygen therapy. The administration of antibiotics was terminated only when a distinct improvement in the condition of the patients took place and there were indications that the process of normal blood formation had been restored. The diet was gradually and constantly increased in variety. One must note that during the period of recovery, the patients developed a good appetite and began to add weight.

A more active stimulation of the formation of blood began when regenerative processes in the spinal cord had started. All drugs mentioned above were used in the commonly accepted doses.

The methods of therapy outlined above are not specific for radiation sickness. It is necessary to note that the degree of acuteness of radiation sickness and its outcome when the doses of drugs mentioned above are given to the patients is in many respects determined by the development of hemorrhagic symptoms and complications due to infection, which arise against the background of suppression of hemopoiesis and in their turn aggravate the latter. An early prophylactic application of antibiotics and various hemostatic agents should be regarded as an effective means of carrying out a therapy of acute radiation sickness which contributes to an alleviation of the acute nature of the illness and expedites clinical recovery.

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